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# National Center of Forest Health Management/Forest Health Protection

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TECHNOLOGY  
TRANSFER

*Bibliography*

## The Effects of *Bacillus thuringiensis* var. *kurstaki* on Non-targets

Amy Onken  
Steve Munson  
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THE EFFECTS OF  
*BACILLUS THURINGIENSIS* VAR. *KURSTAKI*  
ON NON-TARGETS BIBLIOGRAPHY

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## Preface

The following is a subset of the *Bacillus thuringiensis* bibliography which is maintained by USDA Forest Service, Forest Health Protection, Morgantown, WV. All references pertaining to the effects of *Bacillus thuringiensis* var. *kurstaki* on non-targets have been categorized (see table of contents) and references for each category are listed in alphabetical order by author's name. Copies of articles can be received from the Morgantown office, but only from references that are preceded by double asterisks (\*\*). This list of *Bacillus thuringiensis* var. *kurstaki* non-target references will be updated every 6 months.

If you have any questions or would be interested in receiving copies of articles, please contact:

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# INVERTEBRATES



## ACARI- MITES

CHAPMAN M H; HOY M A

RELATIVE TOXICITY OF BACILLUS-THURINGIENSIS-VAR-TENEBRIONIS TO THE TWO-SPOTTED SPIDER MITE TETRANYCHUS-URTICAE KOCH AND ITS PREDATOR METASEIULUS-OCCIDENTALIS NESBITT ACARI TETRANYCHIDAE AND PHYTOSEIIDAE J APPL ENTOMOL 111 (2). 1991. 147-154.

Full Journal Title: Journal of Applied Entomology

### ABSTRACT

*Bacillus thuringiensis* var. *tenebrionis* (Btte) wettable powders were tested in the laboratory to determine their relative toxicity to the two-spotted spider mite (*Tetranychus urticae* Koch) and its predator *Metaseiulus* (= *Typhlodromus*) *occidentalis* (Nesbitt). These microbial preparations, when tested at 0.1X, 0.5X, and 1.0X the recommended field rate of 0.9 kg ai/75.7 l/acre (2.0 lb ai/20.0 al/acre) caused little mortality to adult females of *T. urticae* but were considerably more toxic to *M. occidentalis* females at 48 h. Female *T. urticae* exhibited 90.0  $\pm$  14.2% survival vs. 26.0  $\pm$  23.4% survival for *M. occidentalis* at the field rate. Starvation of female predators for 24 h prior to treatment and Btte wettable powder significantly increased mortality. Neither predator nor spider mite eggs treated with Btte wettable powder at the field rate suffered a depression in hatch rate (98.0% and 97.2% hatch, respectively, of eggs treated when 24 h old). However, only 65.0% of the resulting immature predators reached adulthood compared to 88.8% of the immature spider mites. Female predators which survived treatment as eggs and developed on residues did not show a significant decrease in fecundity. Thus, under these laboratory conditions, Btte was moderately toxic to predator mites. Finally, treatment of *M. occidentalis* females with other Btte products (Mycogen M-ONE and Sandoz Trident) and with *B. t.* var. *kurstaki* (Dipel 2x) also resulted in significant mortality.

Keywords/ TYPHLODROMUS-OCCIDENTALIS BACILLUS-THURINGIENSIS-VAR-KURSTAKI ORCHARD VINEYARD ADULT FEMALE MALE EGG IMMATURE STARVATION HATCH RATE MORTALITY FECUNDITY SURVIVAL NON-TARGET ORGANISM WETTABLE POWDER MYCOGEN M-ONE DIPEL 2X SANDOZ TRIDENT

HARDMAN,-J.M.; GAUL,-S.O.

MIXTURES OF BACILLUS THURINGIENSIS AND PYRETHROIDS CONTROL WINTER MOTH (LEPIDOPTERA: GEOMETRIDAE) IN ORCHARDS WITHOUT CAUSING OUTBREAKS OF MITES. J-ECON-ENTOMOL. JUNE 1990. V. 83 (3) 920-936.

Full Journal Title: Journal of Economic Entomology

Language: English

### ABSTRACT

Extensive trials with mixtures of *Bacillus thuringiensis* var. *kurstaki* Berliner (Dipel wettable powder) and pyrethroids showed the efficacy of these mixtures against winter moth, *Operophtera brumata* (L.), and their compatibility, with integrated mite control in apple (*Malus domestica* Borkh.) orchards. In the mixtures, concentrations of the pyrethroids (cypermethrin, deltamethrin, fenvalerate, and permethrin) were one-tenth of the recommended orchard rates. Levels of winter moth injury to harvested fruit were as low with the mixtures of Dipel and pyrethroids as with half-rate or full-rate treatments of pyrethroids. Prebloom application of several mixtures significantly reduced fruit injury caused by mirids, mostly *Atractotomus mali* (Meyer) and *Campylomma verbasci* (Meyer), and the pale apple leafroller, *Pseudexentera mali* Freeman, and the obliquebanded leafroller, *Choristoneura rosaceana* (Harris). Counts of European red mite, *Panonychus ulmi* (Koch), and apple rust mite, *Aculus schlechtendali* (Nalepa), were lower, and populations of their principal natural enemy, *Typhlodromus pyri* Scheuten, were detected more frequently in plots treated with Dipel-pyrethroid mixtures than in plots treated with pyrethroids at half or full rates. Levels of leaf bronzing induced by European red mite and apple rust mite were also less where mixtures were used. The mixture of Dipel with the emulsifiable concentrate formulation of cypermethrin was particularly, compatible with integrated mite control. Counts of European red mite and levels of leaf



bronzing induced by European red mite with this mixture did not differ from the levels observed in the plots treated with Dipel alone.

Keywords/ MALUS-. ORCHARDS-. OPEROPHTERA-BRUMATA. BACILLUS-THURINGIENSIS. PYRETHROIDS-. CC NSECTICIDAL-ACTION. MITES-. NATURAL-ENEMIES. PANONYCHUS-ULMI. TYPHLODROMUS-PYRI. CROP-DAMAGE. CROP-YIELD. NOVA-SCOTIA. MALUS-DOMESTICA.





## ARANEAE- SPIDERS

*HILBURN, D. J.; JENNINGS, D. T.*

TERRICOLOUS SPIDERS (ARANEAE) OF INSECTICIDE-TREATED SPRUCE-FIR FORESTS IN WEST-CENTRAL MAINE.

GREAT LAKES ENTOMOLOGIST 1988. 21 (3): 105-114 (38 REF.)

### ABSTRACT

The impact of carbaryl (Sevin-4-oil) and 2 formulations of *Bacillus thuringiensis* (Thuricide 16B and Dipel 4L) on spiders was studied in spruce fir (*Picea* spp.) forests in Maine in 1980. Following aerial spraying with carbaryl, Dipel and Thuricide at 2.9, 9.35 and 5.8 litre/ha, 12 families, 42 genera and 62 species of Araneae were captured in linear-pitfall traps. Species richness per family ranged from 1 (Theridiidae, Araneidae, Salticidae) to 19 (Erigonidae). Most trapped species were web-spinners (67.2%) while most trapped individuals were hunters (75.2%). Lycosidae accounted for 66.1% of all 887 capture spiders. Total trapped spiders varied among insecticide treatments, sampling dates and study sites. Comparison of mean prespray and postspray trap catches indicated no significant reduction following insecticide treatments. Increases in abundance during postspray sampling periods may have masked detection of treatment effects.



## AQUATIC INSECTS

### **\*\*EIDT D C**

TOXICITY OF BACILLUS-THURINGIENSIS-VAR-KURSTAKI TO AQUATIC INSECTS

CAN ENTOMOL 117 (7). 1985. 829-838.

Full Journal Title: Canadian Entomologist

#### ABSTRACT

Representative aquatic insects, larvae of Simuliidae, Chironomidae, Trichoptera, Megaloptera, and nymphs of Ephemeroptera and Plecoptera, were tested for susceptibility to continuous exposure to *B. thuringiensis* Berliner var. *kurstaki* at 4.3, 43, and 430 IU/ml. Only *Simulium vittatum* was affected, and at the highest concentration. Effects on other organisms, particularly *Prosimulium fuscum* P. mixtum, were suggested. The lowest of the concentrations tested was twice the worst-case transitory concentration peaks expected in water from aerial forest spraying at 30 BIU/ha. Spray buffer zones around water bodies are unnecessary at this spray rate.

### *EIDT, D. C.*

B. T. BUDWORM SPRAY IS INNOCUOUS TO AQUATIC INSECTS.

TECHNICAL NOTE, MARITIMES FOREST RESEARCH CENTRE, CANADA 1984. (NO. 114): 4 PP.

#### ABSTRACT

*Bacillus thuringiensis* (Thuricide 32 LV), which is used to control spruce budworm [*Choristoneura fumiferana*], was tested on laboratory rearings of aquatic insects to determine the margin of safety for use near streams. Concentrations of 4.3, 43 and 430 iu/ml were used. Of various species of black flies, caddisflies, midges, stoneflies, mayflies and dobsonflies tested, only one species of black fly (named as '*Prosimulium fuscum/mixtum*') larva was significantly affected, and it was concluded that there is no cause for concern about the effects of B.t. sprays on aquatic insects.

### *KREUTZWEISER,-D.P. ; HOLMES,-S.B.; CAPELL,-S.S.; EICHENBERG,-D.C.*

LETHAL AND SUBLETHAL EFFECTS OF BACILLUS THURINGIENSIS VAR. KURSTAKI ON AQUATIC INSECTS IN LABORATORY BIOASSAYS AND OUTDOOR STREAM CHANNELS.

BULL-ENVIRON-CONTAM-TOXICOL. AUG 1992. V. 49 (2) 252-257

Full Journal Title: Bulletin of environmental contamination and toxicology

LANGUAGE: English

Keywords/ BACILLUS-THURINGIENSIS-SUBSP.-KURSTAKI. AQUATIC-INSECTS. NONTARGET-ORGANISMS. TOXICITY-. SUBLETHAL-EFFECTS. MORTALITY-. STREAMS-. BIOASSAYS-.

### *KREUTZWEISER,-D.P.; CAPELL,-S.S.*

A SIMPLE STREAM-SIDE TEST SYSTEM FOR DETERIMING ACUTE LETHAL AND BEHAVIORAL EFFECTS OF PESTICIDES ON AQUATIC INSECTS.

ENVIRON-TOXICOL-CHEM. JULY 1992. V. 11 (7) 993-999.

Full Journal Title: Environmental Chemistry and Toxicology

Paper presented at the "Symposium on Structure-Activity and Structure-Property Relationships in Environmental Chemistry and Toxicology, Pacificen '89," December 17-22, 1989, Honolulu, Hawaii.

Keywords/ BACILLUS-THURINGIENSIS-SUBSP.-KURSTAKI. HEXAZINONE-. PERMETHRIN-. TRICLOPYR-. AQUATIC-INSECTS. TOXICITY-. TESTS-. ANIMAL-BEHAVIOR. STREAMS-. PESTICIDE-RESIDUES. NONTARGET-ORGANISMS. NONTARGET-EFFECTS. WATER-POLLUTION.DRIFT-RESPONSE-BEHAVIOR.



*KINGSBURY, P. D.*

MONITORING AQUATIC INSECT POPULATIONS IN FOREST STREAMS EXPOSED TO  
CHEMICAL AND BIOLOGICAL INSECTICIDE APPLICATIONS.

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO 1975, PUBL. 1976.106 19-24  
(10 REF., 2 FIG.)

ABSTRACT

Two methods (Surber sampling and drift netting) that have been used in Canada with little change since they were introduced in about 1952 to monitor the effects on aquatic organisms of control operations against insect pests of forests are described with 2 case histories. Both methods were used in a river exposed to aerially applied *Bacillus thuringiensis* in Ontario in 1973, and revealed no significant adverse effects on aquatic insects. Drift netting in a New Brunswick river in 1974 revealed increases in the drift of aquatic insects and knockdown of terrestrial insects attributable to the large-scale application of phosphamidon in sprays from aircraft for the control of *Choristoneura fumiferana* (Clem.).

*SURGEONER, G. A. ; FARKAS, M. J.*

REVIEW OF *BACILLUS THURINGIENSIS* VAR. *KURSTAKI* (BTK) FOR USE IN FOREST PEST  
MANAGEMENT PROGRAMS IN ONTARIO, WITH SPECIAL EMPHASIS ON THE AQUATIC  
ENVIRONMENT

ONTARIO MINISTRY OF THE ENVIRONMENT, TORONTO. WATER RESOURCES BRANCH.  
CORP. SOURCE REPORT NO.: ISBN-0-7729-6453-X C1990 99P

ABSTRACT

In response to the preparation of a class environmental assessment for timber management on Crown lands, a study of *Bacillus thuringiensis* var. *kurstaki* (Btk) was undertaken for use in the forest pest management programs of Ontario. This review focuses on the aquatic ecosystem effects of Btk and considers its effects on non-target terrestrial biota (wildlife and humans) through contact and ingestion of contaminated water and/or biota. The intent was to develop a provincial water quality objective (PWQO) from the review document. However, the difficulty in enumerating Btk in water has prohibited the development of a numerical PWQO. Instead, a narrative environmental impact statement has been prepared and is provided.



## COLEOPTERA- BEETLES

*BABRIKOVA, T.; LECHEVA, I.*

THE EFFECT OF SYNTHETIC PYRETHROIDS ALONE AND IN COMBINATION WITH DIPEL ON THE SEVEN-SPOTTED LADYBIRD (*COCCINELLA SEPTEMPUNCTATA* L., COLEOPTERA: COCCINELLIDAE).

POCHVOZNANIE, AGROKHIMIYA I RASTITELNA ZASHCHITA 1986. 21 (4): 107-110 (11 REF., 2 FIG.)

Language: Bulgarian Summary Language: English; Russian

### ABSTRACT

The synthetic pyrethroids Permasect [permethrin], Sherpa [cypermethrin], Vaztac [the [1alpha(S\*),3alpha]-(plus or minus)-isomer of cypermethrin], Ripcord [cypermethrin], Ambush [permethrin] and Decis [deltamethrin] alone or in combination with Dipel [containing *Bacillus thuringiensis* subsp. *kurstaki*] were tested for their effects on the predator *Coccinella septempunctata*. When applied at low rates (0.02%), the pyrethroids were highly toxic to adults, causing 68.7-100% mortality. Combinations of Dipel with 10-fold reduced dosages of pyrethroids were less toxic: 0.1% Dipel + 0.002% Ambush and 0.1% Dipel + 0.002% Permasect were moderately toxic and of interest for use in integrated control programmes involving *C. septempunctata*.

*CAMERON E A; REEVES R M*

CARABIDAE (COLEOPTERA) ASSOCIATED WITH GYPSY MOTH, *LYMANTRIA DISPAR* (L.) (LEPIDOPTERA: LYMANTRIIDAE), POPULATIONS SUBJECTED TO *BACILLUS THURINGIENSIS* BERLINER TREATMENTS IN PENNSYLVANIA

CAN ENTOMOL 1990, 122 (1-2) 123-129

Full Journal Title: Canadian Entomologist

Language: English Summary Language: French

Etude des effets possibles de l'application de *B. t.* sur les activités prédatrices de Carabidae

*HABIB, M. E. M.; AMARAL, M. E. C. TURNIPSEED, S. G.*

AERIAL APPLICATION OF *BACILLUS THURINGIENSIS* AGAINST THE VELVETBEAN CATERPILLAR, *ANTICARSIA GEMMATALIS* HUEBNER, IN SOYBEAN FIELDS.

REVISTA DE AGRICULTURA, BRAZIL 1985. 60 (2): 141-149 (21 REF.)

Language: English Summary Language: Portuguese

### ABSTRACT

Applications from an aircraft of 8X109 IU/ha of *Bacillus thuringiensis* subsp. *kurstaki* in a wettable powder formulation (with a flow rate of 20 litres/ha), gave good control of larvae of the noctuid *Anticarsia gemmatalis* on soybean in tests in Mato Grosso do Sul, Brazil. Treatments were applied when infestation reached 25 larvae/m (using the drop-sheet method of S.G. Turnipseed (1974)). The larvae ceased feeding about 6 h after the application, and mortality began 24 h after it. The corrected mortality percentages after 2, 4 and 7 days were 58.7, 68.1 and 73.3, respectively. This treatment also resulted in a 30% increase in production, as compared with that from plots treated conventionally with chemical insecticides. It did not reduce populations of the key parasite (the ichneumonid *Macrocharops bimaculata*) nor those of the key predator (the carabid *Calosoma granulatum* [*C. alternans granulatum*]); populations of the pentatomid *Nezara viridula* did not reach their economic injury level in the area so treated. Emulsified formulations of *B. t. kurstaki* did not afford an adequate uniformity of deposition, resulting in a lower mortality of *A. gemmatalis*.

*HAVERTY, M. I.*

SENSITIVITY OF SELECTED NONTARGET INSECTS TO THE CARRIER OF DIPEL 4L IN THE LABORATORY.





ENVIRONMENTAL ENTOMOLOGY 1982. 11 (2): 337-338 (2 REF.)

ABSTRACT

A 3:1 mixture of water and the carrier of Dipel 4L (a non-aqueous, emulsifiable suspension of *Bacillus thuringiensis* subsp. *kurstaki*) was applied to selected insect predators and a parasite in a controlled laboratory environment. Corrected mortality from the 9.4-litre/ha application never exceeded 2.1% for any species. The 18.7-litre/ha rate resulted in a statistically significant increase in mortality for adults of the chrysopid *Chrysoperla carnea* (Steph.) (*Chrysopa carnea*) and the coccinellid *Hippodamia convergens* (Guer.) 3 and 7 days after treatment, but not for larvae of *C. carnea* or adults of the aphelinid *Aphytis melinus* DeBach. Corrected mortality for the higher application rate never exceeded 13.4% for any species.

*HORN, D. J.*

SELECTIVE MORTALITY OF PARASITIDS AND PREDATORS OF MYZUS PERSICAE ON COLLARDS TREATED WITH MALATHION, CARBARYL, OR BACILLUS THURINGIENSIS.

ENTOMOLOGIA EXPERIMENTALIS ET APPLICATA 1983. 34 (2): 208-211 (17 REF.)

ABSTRACT

A field trial was carried out in Ohio in June-July 1977 to determine the selective effects of insecticides on predators and secondary parasites (Coccinellidae, Syrphidae, Tachinidae, Encyrtidae and Pteromalidae) of *Myzus persicae* (Sulz.) on kale (collards). The numbers of aphids increased markedly on kale treated with carbaryl, which may have been due to elimination of both predators and competitors (larvae of *Artogeia rapae* (L.) (*Pieris rapae*) and *Plutella xylostella* (L.) and adults of *Phyllotreta* spp.). The lowest aphid densities were observed after treatment with malathion, but these were not significantly lower than those on water-treated control plants, on which predators apparently kept densities down, aided by the poorer-quality vegetation resulting from feeding by the other pests. Aphid densities became significantly higher in plots treated with *Bacillus thuringiensis* subsp. *kurstaki* (Dipel); these plants showed little defoliation and had small numbers of syrphid larvae. *Diaeretiella rapae* (M'Intosh) was parasitised by a complex of secondary parasites, mainly *Asaphes lucens* (Prov.) and *Aphidencirtus aphidivorus* (Mayr), which were attracted to higher densities of the parasite; secondary parasitism appeared to be selectively reduced by both malathion and carbaryl.

*OBADOFIN, A.A. ; FINLAYSON, D.G.*

INTERACTION OF SEVERAL INSECTICIDES AND A CARABID PREDATOR BEMBIDION LAMPROS (HRBST.) AND THEIR EFFECTS ON HYLEMYA BRASSICAE (BOUCHE).;

CAN. J. PLANT SCI. ; 57(4), 1121-1125 1977 ;

ABSTRACT

*B. lampros* (Col.) is an important egg predator of the cabbage maggot *H. brassicae* (Dipt., Anthomyiidae) but populations may be seriously reduced by application of broad spectrum insecticides for the control of other pests. The efficiency of *B. lampros* as a predator of *H. brassicae* eggs and the effects of 3 insecticides on the beetle were determined in experimental plots of Brussels sprouts. In untreated plots, *B. lampros* ate 45% of the *H. brassicae* eggs. In plots treated with methomyl, *Bacillus thuringiensis* (Dipel), and chlorfenvinphos, egg numbers were reduced 35, 44 and 66%, respectively. One subsurface application of chlorfenvinphos granules, early in the season, prevented damage by the cabbage maggot and was not toxic to the beetle. Foliar applications of methomyl significantly reduced the number of *B. lampros*. In laboratory tests with methomyl at 0.1, 0.5, 0.025 and 0.0125%, the mortality of *B. lampros* was 100, 70, 40 and 0%, respectively. Dipel sprays at 0.1 or 0.5% and chlorfenvinphos in the soil at 10 or 40 ppm caused only slight mortality.



## DIPTERA-FLIES

*BEIGER, M.*

THE EFFECT OF INSECTICIDES APPLIED AGAINST THE NUN MOTH ON THE OCCURRENCE AND ABUNDANCE OF LEAF-MINING INSECTS.

POLSKIE PISMO ENTOMOLOGICZNE 1987. 57 (2): 373-376 (3 REF.)

Language: Polish Summary Language: English

Field trials in Poland in 1981-84 showed that Ripcord [cypermethrin], Decis [deltamethrin] and Bactospeine [*Bacillus thuringiensis* subsp. *thuringiensis*] applied against the forest pest *Lymantria monacha* significantly reduced the abundance of leaf-mining insects of the orders Lepidoptera, Diptera and Hymenoptera on forest trees and shrubs.

*DUNBAR, D. M.; KAYA, H. K.; DOANE, C. C.; ANDERSON, J. F.; WESELOH, R. M.*

AERIAL APPLICATION OF *BACILLUS THURINGIENSIS* AGAINST LARVAE OF THE ELM SPANWORM AND GYPSY MOTH AND EFFECTS ON PARASITIDS OF THE GYPSY MOTH. BULLETIN, CONNECTICUT EXPERIMENT STATION 1973. (NO. 735): 23 PP. (13 REF., 3 FIG.)

### ABSTRACT

Tests in Cockaponset and Salmon River State Forests, Connecticut, in 1972 showed that larvae of *Ennomos subsignarius* (Hb.) were controlled effectively by single applications of two preparations of spores of *Bacillus thuringiensis*, Thuricide HPC and IMC 90012, at one and two US quarts/acre, respectively. In Cockaponset, where *E. subsignarius* predominated and *Lymantria* (*Porthetria*) *dispar* (L.) was at a low level, foliage protection was achieved. Net defoliation was less than 25% on treated oaks (including *Quercus alba*, *Q. prinus* and *Q. rubra*) as compared with 52.3% on untreated oaks, and less than 20% on all treated trees (including *Acer rubrum* and *Betula lenta*), as compared with 43.7% on all untreated trees. In Salmon River, net defoliation was held below 40% on treated oaks and 33% on all treated trees, as compared with 51.7 and 52.7% respectively, with no treatment. Although some control of *L. dispar* was achieved, the numbers of egg-masses in posttreatment counts were in most plots greater than before treatment. Treatment had no apparent effect on three parasites of *L. dispar* (*Apanteles melanoscelus* (Ratz.), *Blepharipa scutellata* (R.-D.) and *Parasetigena agilis* (R.-D.)).

*HORN, D. J.*

SELECTIVE MORTALITY OF PARASITIDS AND PREDATORS OF *MYZUS PERSICAE* ON COLLARDS TREATED WITH MALATHION, CARBARYL, OR *BACILLUS THURINGIENSIS*. ENTOMOLOGIA EXPERIMENTALIS ET APPLICATA 1983. 34 (2): 208-211 (17 REF.)

### ABSTRACT

A field trial was carried out in Ohio in June-July 1977 to determine the selective effects of insecticides on predators and secondary parasites (Coccinellidae, Syrphidae, Tachinidae, Encyrtidae and Pteromalidae) of *Myzus persicae* (Sulz.) on kale (collards). The numbers of aphids increased markedly on kale treated with carbaryl, which may have been due to elimination of both predators and competitors (larvae of *Artogeia rapae* (L.) (*Pieris rapae*) and *Plutella xylostella* (L.) and adults of *Phyllotreta* spp.). The lowest aphid densities were observed after treatment with malathion, but these were not significantly lower than those on water-treated control plants, on which predators apparently kept densities down, aided by the poorer-quality vegetation resulting from feeding by the other pests. Aphid densities became significantly higher in plots treated with *Bacillus thuringiensis* subsp. *kurstaki* (Dipel); these plants showed little defoliation and had small numbers of syrphid larvae. *Diaeretiella rapae* (M'Intosh) was parasitised by a complex of secondary parasites, mainly *Asaphes lucens* (Prov.) and *Aphidencyrthus aphidivorus* (Mayr), which were attracted to higher densities of the parasite; secondary parasitism appeared to be selectively reduced by both malathion and carbaryl.

**\*\*KAYA, H.; DUNBAR, D.; DOANE, C.; WESELOH, R.; ANDERSON, J.**



GYPSY MOTH: AERIAL TESTS WITH BACILLUS THURINGIENSIS AND PYRETHROIDS.  
BULLETIN, CONNECTICUT AGRICULTURAL EXPERIMENT STATION 1974. (NO. 744): 22 PP.  
(16 REF., 1 FIG. ; LESS TECHNICAL SHORTER VERSION BULLETIN 744C (6 PP., 1 FIG.)  
INCORPORATED)

#### ABSTRACT

Encouraging results obtained with *Bacillus thuringiensis* [cf. RAE/A 61, 1168] and synthetic pyrethroids [cf. 62, 1538] against *Lymantria* (*Porthetria*) *dispar* (L.) in Connecticut led to further experiments with aerial sprays over a mixed hardwood forest in 1973. Dipel applied at 1 lb/acre (equivalent to  $7.26 \times 10^9$  International Units (IU)/acre) and Thuricide-16 B at 0.5 US gal/acre (equivalent to  $8 \times 10^9$  IU/acre) provided some foliage protection, but the pyrethroids resmethrin and bioethanomethrin did not, since although the knockdown rate was high many larvae recovered, reascended the trees and continued to feed. The numbers of egg-masses in plots treated with the bacillus were significantly lower than in untreated plots, whereas the numbers in pyrethroid-treated and untreated plots were similar; in all plots, however, egg-masses were less numerous after the time of treatment than before. The number of eggs/mass was significantly higher in the bacillus-treated plots than in the others. Differences between the amounts of Thuricide deposited by different spray nozzles are discussed. Sheets spread beneath the trees sprayed with pyrethroids collected larvae and adults of many other non-target insects including a few adults of *Apanteles melanoscelus* (Ratz.), *Brachymeria intermedia* (Nees), *Parasitigena agilis* (R.-D.) and *Blepharipa scutellata* (R.-D.), which are parasites of *L. dispar*; the sprays containing *Bacillus thuringiensis* primarily affected larvae of Lepidoptera and adult beetles. Bound in with this paper (but detachable from it) is a simpler and shorter version with its own cover.



## HYMENOPTERA-PARASITIC WASPS, AND BEES

*BEIGER, M.*

THE EFFECT OF INSECTICIDES APPLIED AGAINST THE NUN MOTH ON THE OCCURRENCE AND ABUNDANCE OF LEAF-MINING INSECTS.

POLSKIE PISMO ENTOMOLOGICZNE 1987. 57 (2): 373-376 (3 REF.)

Language: Polish Summary Language: English

Field trials in Poland in 1981-84 showed that Ripcord [cypermethrin], Decis [deltamethrin] and Bactospeine [*Bacillus thuringiensis* subsp. *thuringiensis*] applied against the forest pest *Lymantria monacha* significantly reduced the abundance of leaf-mining insects of the orders Lepidoptera, Diptera and Hymenoptera on forest trees and shrubs.

*BRUNNER, E.; STEVENS, P. F. E.*

THE CONTROL OF DIAMONDBACK MOTH WITH THURICIDE.

SHANHUA, TAIWAN: ASIAN VEGETABLE RESEARCH AND DEVELOPMENT CENTER 1986. 213-217 (6 REF.)

Language: English

ABSTRACT

Thuricide, a *Bacillus thuringiensis* formulation, is active against more than 200 lepidopterous species in the larval stage. Efficacy is greatest when Thuricide is applied at hatching time and/or on 1st-3rd larval instars during their intensive feeding period. Since Thuricide must be eaten by the insect to be effective, thorough leaf coverage is essential for best results. Thuricide HP [*B. t.* subsp. *kurstaki*] is used in most areas of Asia where the yponomeutid *Plutella xylostella* is a serious pest. In field trials on cabbage in Malaysia, Indonesia and Australia and on cabbage and cauliflower in India, this product has been shown to give control of *P. xylostella* comparable to or better than standard organophosphorus insecticides. Thuricide has no adverse effect on hymenopterous parasites of *P. xylostella*.

*CAMPBELL, -C.D.; WALGENBACH, -J.F.; KENNEDY, -G.G.*

EFFECT OF PARASITOIDS ON LEPIDOPTEROUS PESTS IN INSECTICIDE-TREATED AND UNTREATED TOMATOES IN WESTERN NORTH CAROLINA.

J-ECON-ENTOMOL. DEC 1991. V. 84 (6) P. 1662-1667.

Full Journal Title: Journal of Economic Entomology

Language: English

ABSTRACT

Studies were conducted in 1988 and 1989 to identify the parasitoid complex of lepidopterous pests of tomatoes in western North Carolina, and to assess the compatibility, of various insecticides with natural control of these pests. *Trichogramma exiguum* (Pinto & Platner) and *T. pretiosum* (Riley) were the primary egg parasitoids of *Helicoverpa* (= *Heliothis*) *zea* (Boddie) and *Manduca* spp. in 1988, whereas *T. exiguum* was the predominant species collected from *H. zea* and *Trichoplusia ni* (Hubner) in 1989. Parasitization of *H. zea* eggs on plants treated with endosulfan, methomyl, and *Bacillus thuringiensis* Berliner var. *kurstaki* did not differ significantly from the untreated control. However, egg densities were higher in synthetic insecticide treatments presumably because of disruption of predators in these treatments. Despite the low toxicity of esfenvalerate to *Trichogramma* spp. in laboratory bioassays, parasitization of *H. zea* and *Heliothis virescens* (F.) eggs in the field was significantly reduced on esfenvalerate-treated tomatoes. This decreased level of parasitization was attributed to an avoidance by *Trichogramma* spp. to pyrethroid insecticides, which was previously reported. Under the relatively low-density lepidopterous populations observed in these studies, the efficacy of specific insecticides against *H. zea* and *T. ni* was more important in preventing damage than the level of parasitization of these pests, because the treatment with the lowest level of parasitization (esfenvalerate + *B. thuringiensis*) had the lowest levels of fruit damage in both years.





Keywords/: LYCOPERSICON-ESCULENTUM. CROP-DAMAGE. HELICOVERPA-ZEA. HELIOTHIS-VIRESCENS. MANDUCA-. TRICHOPLUSIA-NI. BIOLOGICAL-CONTROL. BACILLUS-THURINGIENSIS. PARASITES-OF-INSECT-PESTS. TRICHOGRAMMA-. INSECTICIDAL-ACTION. ENDOSULFAN-. METHOMYL-. NORTH-CAROLINA. ENSFENVALERATE-.

*DHOUIBI, M. H.*

EFFECT OF BACTOSPEINE XLV ON THE DATE PYRALID ECTOMYELOIS CERATONIAE ZELLER (LEPIDOPTERA: PYRALIDAE). MEDEDELINGEN VAN DE FACULTEIT LANDBOUWWETENSCHAPPEN, RIJKSUNIVERSITEIT GENT VOL. 57. 1992. (2B): P.505-514

Language: French Summary Language: English

ABSTRACT

The effect of *Bacillus thuringiensis* subsp. *kurstaki* (Bactospeine) on the larvae of *Ectomyelois ceratoniae* (*Apomyelois ceratoniae*) was evaluated in date palm plantations in Tunisia. Treatment had no knock down effect on larvae. High (17.3%) mortality of 1st-instar larvae, 3.44% mortality of 2nd-instar larvae and negligible mortality of 3rd-instar larvae was recorded 15 days after treatment. Fruit quality was higher in treated areas. No effect on parasitism by *Phanerotoma flavitestacea* (*P. ocularis*) was observed. This paper was presented at the International Symposium on Crop Protection. 9 ref.

Keywords/ NATURAL ENEMIES; NONTARGET EFFECTS; MICROBIAL PESTICIDES; INSECT PESTS; DATES; PLANTATIONS; CONTROL; BIOLOGICAL CONTROL; PARASITIDS; HYMENOPTERA; HOSTS; PATHOGENS; ENTOMOPATHOGENIC BACTERIA; PEST CONTROL; SUBTROPICAL FRUITS; FRUIT CROPS; AGRICULTURAL ENTOMOLOGY; BIOLOGICAL CONTROL AGENTS

*\*\*DUNBAR, D. M.; KAYA, H. K.; DOANE, C. C.; ANDERSON, J. F.; WESELOH, R. M.* AERIAL APPLICATION OF BACILLUS THURINGIENSIS AGAINST LARVAE OF THE ELM SPANWORM AND GYPSY MOTH AND EFFECTS ON PARASITIDS OF THE GYPSY MOTH. BULLETIN, CONNECTICUT EXPERIMENT STATION 1973. (NO. 735): 23 PP. (13 REF., 3 FIG.)

ABSTRACT

Tests in Cockaponset and Salmon River State Forests, Connecticut, in 1972 showed that larvae of *Ennomos subsignarius* (Hb.) were controlled effectively by single applications of two preparations of spores of *Bacillus thuringiensis*, Thuricide HPC and IMC 90012, at one and two US quarts/acre, respectively. In Cockaponset, where *E. subsignarius* predominated and *Lymantria* (*Porthetria*) *dispar* (L.) was at a low level, foliage protection was achieved. Net defoliation was less than 25% on treated oaks (including *Quercus alba*, *Q. prinus* and *Q. rubra*) as compared with 52.3% on untreated oaks, and less than 20% on all treated trees (including *Acer rubrum* and *Betula lenta*), as compared with 43.7% on all untreated trees. In Salmon River, net defoliation was held below 40% on treated oaks and 33% on all treated trees, as compared with 51.7 and 52.7% respectively, with no treatment. Although some control of *L. dispar* was achieved, the numbers of egg-masses in posttreatment counts were in most plots greater than before treatment. Treatment had no apparent effect on three parasites of *L. dispar* (*Apanteles melanoscelus* (Ratz.), *Blepharipa scutellata* (R.-D.) and *Parasetigena agilis* (R.-D.)).

*FERNANDEZ B., R. I.; CLAVIJO A., S.*

EFFECTS OF TWO INSECTICIDES (ONE CHEMICAL AND THE OTHER BIOLOGICAL) ON THE PARASITISM OBSERVED IN LARVAE OF SPODOPTERA FRUGIPERDA (S.) FROM EXPERIMENTAL PLOTS OF MAIZE.

REVISTA DE LA FACULTAD DE AGRONOMIA, UNIVERSIDAD CENTRAL DE VENEZUELA 1984. 13 (1/4): 101-109 (17 REF., 1 FIG.)

Language: Spanish Summary Language: English

ABSTRACT



In tests on maize in Carabobo State, Venezuela, it was demonstrated that populations of parasites of *Spodoptera frugiperda* (mainly braconids of the genera *Meteorus*, *Chelonus* and *Apanteles* and an ichneumonid of the genus *Eiphosoma*) were significantly lower following applications of liquid or granular formulations of diazinon to control *S. frugiperda* than they were when Thuricide (containing *Bacillus thuringiensis* var. *kurstaki*) had been applied or when the plots were left untreated. The comparative susceptibility of the different parasite species to diazinon is described and discussed. *Meteorus* sp. was the most susceptible and *Apanteles* sp. the least susceptible.

*GARCIA R., J. L.*

EFFECT OF DIAZINON, DELTAMETHRIN AND BACILLUS THURINGIENSIS VAR. KURSTAKI ON THE CONTROL OF LARVAE OF LEPIDOPTERA ON CABBAGE.

BOLETIN DE ENTOMOLOGIA VENEZOLANA VOL. 6. 1991. (1): P.19-25

Language: Spanish Summary Language: english

#### ABSTRACT

Studies were carried out in a cabbage crop in Venezuela to compare the effect of diazinon at 1.5 litres, deltamethrin at 0.4 litres and *Bacillus thuringiensis* subsp. *kurstaki* at 1 kg/ha on the control of larvae of *Plutella xylostella* and *Leptophobia aripa*. The effect of the insecticides on 2 parasitoids, including *Diadegma insulare*, was also evaluated. *B. thuringiensis* and deltamethrin gave the best results. *B. thuringiensis* was recommended as the best control measure with no adverse effect on the beneficial fauna and no toxic residues. Diazinon had little effect on the pest and population recurrence was observed after applications. 10 ref.

Keywords/ INSECT PESTS; BENEFICIAL INSECTS; NATURAL ENEMIES; LEAFY VEGETABLES; CABBAGES; CONTROL; BIOLOGICAL CONTROL; DIAZINON; CHEMICAL CONTROL; FIELDS; PARASITIDS; MICROBIAL PESTICIDES; EVALUATION; NONTARGET EFFECTS; INSECTICIDES; PEST CONTROL; AGRICULTURAL ENTOMOLOGY; PATHOGENS; BIOLOGICAL CONTROL AGENTS

*HABIB, M. E. M.; AMARAL, M. E. C.*

AERIAL APPLICATION OF BACILLUS THURINGIENSIS AGAINST THE VELVETBEAN CATERPILLAR, ANTICARSIA GEMMATALIS HUEBNER, IN SOYBEAN FIELDS.

REVISTA DE AGRICULTURA, BRAZIL 1985. 60 (2): 141-149 (21 REF.)

Language: English Summary Language: Portuguese

#### ABSTRACT

Applications from an aircraft of 8X10<sup>9</sup> IU/ha of *Bacillus thuringiensis* subsp. *kurstaki* in a wettable powder formulation (with a flow rate of 20 litres/ha), gave good control of larvae of the noctuid *Anticarsia gemmatalis* on soyabean in tests in Mato Grosso do Sul, Brazil. Treatments were applied when infestation reached 25 larvae/m (using the drop-sheet method of S.G. Turnipseed (1974)). The larvae ceased feeding about 6 h after the application, and mortality began 24 h after it. The corrected mortality percentages after 2, 4 and 7 days were 58.7, 68.1 and 73.3, respectively. This treatment also resulted in a 30% increase in production, as compared with that from plots treated conventionally with chemical insecticides. It did not reduce populations of the key parasite (the ichneumonid *Macrocharops bimaculata*) nor those of the key predator (the carabid *Calosoma granulatum* [*C. alternans granulatum*]); populations of the pentatomid *Nezara viridula* did not reach their economic injury level in the area so treated. Emulsified formulations of *B. t. kurstaki* did not afford an adequate uniformity of deposition, resulting in a lower mortality of *A. gemmatalis*.

*HORN, D. J.*

SELECTIVE MORTALITY OF PARASITIDS AND PREDATORS OF MYZUS PERSICAE ON COLLARDS TREATED WITH MALATHION, CARBARYL, OR BACILLUS THURINGIENSIS. ENTOMOLOGIA EXPERIMENTALIS ET APPLICATA 1983. 34 (2): 208-211 (17 REF.)



Language: English

#### ABSTRACT

A field trial was carried out in Ohio in June-July 1977 to determine the selective effects of insecticides on predators and secondary parasites (Coccinellidae, Syrphidae, Tachinidae, Encyrtidae and Pteromalidae) of *Myzus persicae* (Sulz.) on kale (collards). The numbers of aphids increased markedly on kale treated with carbaryl, which may have been due to elimination of both predators and competitors (larvae of *Artogeia rapae* (L.) (*Pieris rapae*) and *Plutella xylostella* (L.) and adults of *Phyllotreta* spp.). The lowest aphid densities were observed after treatment with malathion, but these were not significantly lower than those on water-treated control plants, on which predators apparently kept densities down, aided by the poorer-quality vegetation resulting from feeding by the other pests. Aphid densities became significantly higher in plots treated with *Bacillus thuringiensis* subsp. *kurstaki* (Dipel); these plants showed little defoliation and had small numbers of syrphid larvae. *Diaeretiella rapae* (M'Intosh) was parasitised by a complex of secondary parasites, mainly *Asaphes lucens* (Prov.) and *Aphidencyrus aphidivorus* (Mayr), which were attracted to higher densities of the parasite; secondary parasitism appeared to be selectively reduced by both malathion and carbaryl.

*IDRIS A B; GRAFIUS E*

FIELD STUDIES ON THE EFFECT OF PESTICIDES ON THE DIAMONDBACK MOTH  
(LEPIDOPTERA: PLUTELLIDAE) AND PARASITISM BY DIADEGMA INSULARE  
(HYMENOPTERA: ICHNEUMONIDAE)

JOURNAL OF ECONOMIC ENTOMOLOGY, 1993, 86 (4) 1196-1202

#### ABSTRACT

The effects of pesticides on the diamondback moth, *Plutella xylostella* (L.), and parasitism by *Diadegma insulare* (Cresson) was studied at the Michigan State University Entomology Research Farm during July and August 1990. The range of diamondback moth parasitism from three different locations in Michigan was 60.8-83.3%. Pesticides used were *Bacillus thuringiensis* var. *Kurstaki* (Berliner), thiodicarb, thiodicarb + *B. thuringiensis*, chlorpyrifos, permethrin, ICIA 0321 (pyrethroid), and esfenvalerate. Diamondback larval moth mortality was not significantly different among the treated plots but was significantly higher than in untreated plots 3 d after spraying

Keywords/TOXICITY; INSECTICIDE; MORTALITY; NON TARGET ORGANISM; PARASITOID;  
ENTOMOPHAGOUS; INTEGRATED PEST MANAGEMENT; PEST; VEGETABLE CROP;  
PLUTELLA XYLOSTELLA

*IDRIS, A. B.; GRAFIUS, E.*

DIFFERENTIAL TOXICITY OF PESTICIDES TO DIADEGMA INSULARE (HYMENOPTERA:  
ICHNEUMONIDAE) AND ITS HOST, THE DIAMONDBACK MOTH (LEPIDOPTERA:  
PLUTELLIDAE).

JOURNAL OF ECONOMIC ENTOMOLOGY VOL. 86. 1993. (2): P.529-536

#### ABSTRACT

Laboratory studies were conducted to evaluate the differential toxicity of pesticides to adults of *Diadegma insulare* and its host *Plutella xylostella* by leaf-dip and direct-dip bioassays using larvae of *P. xylostella* and residual bioassays using adults of *P. xylostella* and *D. insulare*. None of the pesticides caused 100% mortality to larvae or adults of *P. xylostella* at 1.0 mg a.i./ml (except for *Bacillus thuringiensis* var. *kurstaki* and esfenvalerate on larvae and adults, resp.). However at 1.0 mg a.i./ml, all insecticides except *B. t.* subsp. *kurstaki* were extremely toxic to *D. insulare* within 30 min of treatment. Chlorothalonil was not toxic to larvae or adults of *P. xylostella*, or to *D. insulare* at concn tested. Methomyl was the least toxic insecticide to larvae and adults of *P. xylostella*, but caused 100% mortality to *D. insulare* 24 h after being exposed to 1.0 mg a.i./ml. An integrated approach for control of *P. xylostella* with *B. t.* and *D. insulare* might permit control of *P. xylostella* without directly affecting the ichneumonid. The use of chlorothalonil for controlling crop diseases is compatible with



management of *P. xylostella* because this fungicide does not affect *D. insulare*. However, it may affect entomopathogenic fungi that attack larvae or adults of *P. xylostella* in the field. 36 ref.

Keywords/ Insect pests; Natural enemies; Beneficial insects; Bacterial insecticides; Insecticides; Nontarget effects; Fungicides; parasitoids; hosts; Entomopathogenic bacteria; pesticides; toxicity; Chlorothalonil; pathogenicity; agricultural entomology

*IDRIS A B; GRAFIUS E*

PESTICIDES AFFECT IMMATURE STAGES OF *DIADEGMA INSULARE* (HYMENOPTERA: ICHNEUMONIDAE) AND ITS HOST, THE DIAMONDBACK MOTH (LEPIDOPTERA: PLUTELLIDAE)

JOURNAL OF ECONOMIC ENTOMOLOGY, 1993, 86 (4) 1203-1212

ABSTRACT

Effects of pesticides on immature stages of *Diadegma insulare* (Cresson) and its host, the diamondback moth, *Plutella xylostella* (L.), were studied in the laboratory. Diamondback moth larvae parasitized by *D. insulare* were significantly less sensitive to ingested pesticides than were nonparasitized larvae 48 h after treatment. However, they were equally sensitive to pesticides through contact. *Bacillus thuringiensis* var. *kurstaki* (Berliner) and azinphosmethyl were significantly more toxic to parasitized larvae than permethrin, methomyl, and chlorothalonil if ingested. *D. insulare* adults emerging from pupae that formed from larvae surviving pesticide treatments tended to have more females than those in the control group

Keywords/ TOXICITY; INSECTICIDE; MORTALITY; LARVA; NON TARGET ORGANISM; PARASITOID; ENTOMOPHAGOUS; INTEGRATED PEST MANAGEMENT; PEST; VEGETABLE CROP; *PLUTELLA XYLOSTELLA*

*JACAS, J.; VINUELA, E.; ADAN, A.; BUDIA, F.; ESTAL, P. DEL; MARCO, V.*

SECONDARY EFFECTS OF SOME PESTICIDES USED IN SPANISH OLIVE GROVES ON ADULTS OF *OPIUS CONCOLOR* SZEPL. (HYM. BRACONIDAE), A PARASITOID OF THE OLIVE FLY, *BACTROCERA OLEAE* (GMEL.) (DIP. TEPHRITIDAE).

BOLETIN DE SANIDAD VEGETAL, PLAGAS VOL. 18. 1992. (2): P.315-321

Language: Spanish Summary Language: english

ABSTRACT

A laboratory method for assessing the effects of pesticides on adults of *Opius concolor*, a parasitoid of *Bactrocera oleae*, is described. The test was applied with some of the most widely used pesticides in Spanish olive groves. Only *Bacillus thuringiensis* subsp. *kurstaki* (Bactospeine) and zineb (Fitonil Forte 80) were harmless. Sulfur (Microtox flowable) did not affect parasitoid survival but almost completely inhibited the parasitic performance of the braconid. 17 ref.

Keywords/ INSECT PESTS; NATURAL ENEMIES; BENEFICIAL INSECTS; NONTARGET EFFECTS; ZINEB; SULFUR; INSECTICIDES; EFFECTS; HOSTS; PARASITIDS; ENTOMOPATHOGENIC BACTERIA; PESTICIDES; AGRICULTURAL ENTOMOLOGY

*JIMENEZ, J.; FERNANDEZ, R.*

BEHAVIOUR OF *DIADEGMA* SP. PARASITISM OF *HELIOTHIS VIRESCENS* CATERPILLARS IN FIELD PLOTS WITH DIFFERENT MICROBIOLOGICAL AND CHEMICAL INSECTICIDE TREATMENTS.

CIENCIA Y TECNICA EN LA AGRICULTURA, PROTECCION DE PLANTAS 1985. 8 (3): 67-79 (23 REF.)

Language: Spanish Summary Language: English





Studies were carried out in Cuba in 1979-80 in tobacco fields to determine the effect of several insecticides on the noctuid *Heliothis virescens* and its parasitoid, the ichneumonid *Diadegma* sp. Neither of the microbial pesticides tested, bitoxibacillin (*Bacillus thuringiensis* subsp. *dendrolimus*) and Dipel (*B. thuringiensis* subsp. *kurstaki*), interfered with parasitism of *H. virescens* by *Diadegma* sp. which reached 31 and 80% of 1st- and 3rd-instar larvae, respectively. The insecticide endosulfan at 2.4 kg/ha and 50% WP was also innocuous to the parasitoid.

KATAYAMA, R. W.; COBB, C. H.; BURLEIGH, J. G.; ROBINSON, W. R.  
SUSCEPTIBILITY OF ADULT MICROPLITIS CROCEIPES (HYMENOPTERA: BRACONIDAE) TO  
INSECTICIDES USED FOR HELIOTHIS SPP. (LEPIDOPTERA: NOCTUIDAE) CONTROL.  
FLORIDA ENTOMOLOGIST 1987. 70 (4): 530-532 (4 REF.)

Language: English

The possibility of adverse effects on beneficial insects of chemical sprays applied against *Heliothis zea* [*Helicoverpa zea*] and *Heliothis virescens* on cotton in Arkansas is not usually considered in integrated pest management systems. A laboratory study was therefore undertaken on the susceptibility of adults of *Microplitis croceipes* [*Glabromicroplitis croceipes*], a braconid parasitoid of *Heliothis* and *Helicoverpa* larvae, to 12 insecticides of various types at doses both above and below those normally applied against the noctuids in the field. Biological insecticides (preparations of *Bacillus thuringiensis* (Thuricide) and of the nuclear polyhedrosis virus specific to *Heliothis* spp.) and also pyrethroids (with the exception of permethrin) were the least toxic to the braconid, and organophosphorus compounds were the most toxic. Of the carbamates, methomyl caused mortality but thiodicarb did not, possibly because it was in a flowable formulation. It is concluded that use of methomyl, permethrin or any of the organophosphates tested could seriously affect parasitism, especially in the spring and autumn when adults of *G. croceipes* are abundant in cotton fields.

\*\*KAYA, H.; DUNBAR, D.; DOANE, C.; WESELOH, R.; ANDERSON, J.  
GYPSY MOTH: AERIAL TESTS WITH BACILLUS THURINGIENSIS AND PYRETHROIDS.  
BULLETIN, CONNECTICUT AGRICULTURAL EXPERIMENT STATION 1974. (NO. 744): 22 PP.  
(16 REF., 1 FIG.; LESS TECHNICAL SHORTER VERSION BULLETIN 744C (6 PP., 1 FIG.)  
INCORPORATED)

ABSTRACT

Encouraging results obtained with *Bacillus thuringiensis* [cf. RAE/A 61, 1168] and synthetic pyrethroids [cf. 62, 1538] against *Lymantria* (*Porthetria*) *dispar* (L.) in Connecticut led to further experiments with aerial sprays over a mixed hardwood forest in 1973. Dipel applied at 1 lb/acre (equivalent to  $7.26 \times 10^9$  International Units (IU)/acre) and Thuricide-16 B at 0.5 US gal/acre (equivalent to  $8 \times 10^9$  IU/acre) provided some foliage protection, but the pyrethroids resmethrin and bioethanomethrin did not, since although the knockdown rate was high many larvae recovered, reascended the trees and continued to feed. The numbers of egg-masses in plots treated with the bacillus were significantly lower than in untreated plots, whereas the numbers in pyrethroid-treated and untreated plots were similar; in all plots, however, egg-masses were less numerous after the time of treatment than before. The number of eggs/mass was significantly higher in the bacillus-treated plots than in the others. Differences between the amounts of Thuricide deposited by different spray nozzles are discussed. Sheets spread beneath the trees sprayed with pyrethroids collected larvae and adults of many other non-target insects including a few adults of *Apanteles melanoscelus* (Ratz.), *Brachymeria intermedia* (Nees), *Parasitigena agilis* (R.-D.) and *Blepharipa scutellata* (R.-D.), which are parasites of *L. dispar*; the sprays containing *Bacillus thuringiensis* primarily affected larvae of Lepidoptera and adult beetles. Bound in with this paper (but detachable from it) is a simpler and shorter version with its own cover.

NEALIS, V. G.; FRANKENHUYZEN, K. VAN; CADOGAN, B. L.



CONSERVATION OF SPRUCE BUDWORM PARASITIDS FOLLOWING APPLICATION OF  
BACILLUS THURINGIENSIS VAR. KURSTAKI BERLINER.

CANADIAN ENTOMOLOGIST VOL. 124. 1992. (6): P.1085-1092

ABSTRACT

Field trials conducted in northern Ontario in 1990 and 1991 in stands dominated by balsam fir (*Abies balsamea*) confirmed that the survival of larvae of *Choristoneura fumiferana* parasitized by natural populations of *Apanteles fumiferanae* were greater than the survival of nonparasitized larvae following the application of spray formulations of *Bacillus thuringiensis* subsp. *kurstaki* (as Foray and Dipel). Apparent parasitism by *A. fumiferanae* increased slightly when the application of *B.t.* subsp. *kurstaki* was early (3rd- to 4th-instar larvae) but increased significantly when applications were made later in the season (4th- to 6th-instar larvae). Delaying the timing of the spray conserved parasitoids while providing significant reductions in the densities of *C. fumiferana*, and not compromising the primary objective of *B. t.* subsp. *kurstaki* application, i.e., the protection of current year foliage. The potential for long-term management of *C. fumiferana* through the strategic integration of natural and imposed mortalities is discussed. 19 ref.

Keywords/ INSECT PESTS; FOREST PESTS; FOREST TREES; NATURAL ENEMIES; BENEFICIAL INSECTS; ECOLOGY; POPULATION DYNAMICS; PESTICIDES; MICROBIAL PESTICIDES; HABITATS; PARASITIDS; HOSTS; CONTROL; BIOLOGICAL CONTROL; INSECTICIDES; EFFECTS; NONTARGET EFFECTS; ENTOMOPATHOGENIC BACTERIA; CONIFERS; PARASITES; BACTERIAL INSECTICIDES; CHEMICAL CONTROL; PEST CONTROL; AGRICULTURAL ENTOMOLOGY; PATHOGENS; BIOLOGICAL CONTROL AGENTS

NIWA,-C.G.; STELZER,-M.J.; BECKWITH,-R.C.

EFFECTS OF BACILLUS THURINGIENSIS ON PARASITES OF WESTERN SPRUCE BUDWORM (LEPIDOPTERA: TORTRICIDAE).

J-ECON-ENTOMOL. AUG 1987. V. 80 (4). 750-753.

Full Journal Title: Journal of Economic Entomology

Keywords/ PSEUDOTSUGA-MENZIESII. ABIES-GRANDIS. BACILLUS-THURINGIENSIS. CHORISTONEURA-OCCIDENTALIS. PARASITES-OF-INSECT-PESTS. PESTICIDE-SPECIFICITY. APANTELES-FUMIFERANAE. HYMENOPTERA-. OREGON-. GLYPTA-FUMIFERANAE. PHYTODIETUS-FUMIFERANAE.

OATMAN, E. R.; WYMAN, J. A.; STEENWYK, R. A. VAN; JOHNSON, M. W. (VAN STEENWYK, R. A.)

INTEGRATED CONTROL OF THE TOMATO FRUITWORM (LEPIDOPTERA: NOCTUIDAE) AND OTHER LEPIDOPTEROUS PESTS ON FRESH-MARKET TOMATOES IN SOUTHERN CALIFORNIA.

JOURNAL OF ECONOMIC ENTOMOLOGY 1983. 76 (6): 1363-1369 (6 REF., 2 FIG.)

ABSTRACT

Field-plot tests in southern California in 1978-79 showed that an integrated pest management (IPM) programme, consisting of weekly applications of Dipel (a preparation of *Bacillus thuringiensis* subsp. *kurstaki*) and twice weekly releases of *Trichogramma pretiosum* Ril., was comparable to a commercial programme, consisting of weekly spray applications of methomyl, in controlling larvae of *Heliothis zea* (Boddie) and other lepidopterous pests on summer plantings of fresh-market tomatoes. Mean total fruit injured by all lepidopterous pests in the commercial, IPM and untreated control plots was 0.7, 1.6 and 7.1%, respectively, in 1978 and 0.3, 0.9 and 5.3% in 1979. There were no significant differences in fruit yield or size between the 2 treatment programmes in either year. Methomyl adversely affected predator populations, host eggs and egg parasitisation by *T. pretiosum*, whereas Dipel did not.



THOMS E M; WATSON T F

EFFECT OF DIPEL BACILLUS-THURINGIENSIS ON THE SURVIVAL OF IMMATURE AND ADULT HYPOSOTER-EXIGUAE HYMENOPTERA ICHNEUMONIDAE

J INVERTEBR PATHOL 47 (2). 1986. 178-183.

Full Journal Title: Journal of Invertebrate Pathology

ABSTRACT

The effects of formulations of Dipel (*Bacillus thuringiensis* subsp. *kurstaki*), on immature and adult *Hyposoter exiguae* (Hymenoptera: Ichneumonidae) were assessed, using *Heliothis virescens* (Lepidoptera: Noctuidae) as a host. *H. exiguae* developing in treated hosts had a significantly ( $p = 0.05$ ) lower percentage of pupation and adult emergence compared to parasitoids developing in nontreated hosts. The mean durations of the pupal and adult stages for parasitoids emerging from treated hosts were not generally affected. After 2 days of exposure, the survival of adult males of *H. exiguae* fed suspensions containing viable *B. thuringiensis* spores was significantly lower ( $p = 0.05$ ) than the survival of wasps fed either control (sucrose solution), autoclaved Dipel, or inert formulation powder solutions. Survival of *H. exiguae* fed a low concentration of Dipel was not significantly reduced. Applications of *B. thuringiensis* in the field would very likely adversely affect immature *H. exiguae* more than adults, due to premature host death.

\*\*TICEHURST, M.; FUSCO, R. A.; BLUMENTHAL, E. M.

EFFECTS OF REDUCED RATES OF DIPEL 4L, DYLOX 1.5 OIL, AND DIMILIN W-25 ON LYMANTRIA DISPAR (L.) (LEPIDOPTERA: LYMANTRIIDAE), PARASITISM, AND DEFOLIATION.

ENVIRON ENTOMOL 1982. 11 (5): 1058-1062 (5 REF.)

Full Journal Title: Environmental Entomology

ABSTRACT

Reduced rates of *Bacillus thuringiensis* subsp. *kurstaki* (Dipel 4L) (19.8 BIU/ha), trichlorphon (Dylox 1.5 Oil) (0.37 kg a.i./ha), and diflubenzuron (Dimilin W-25) (4.2 g a.i./ha) were applied to an outbreak of *Lymantria dispar* (L.) in Pennsylvania in 1980. Treatment effects were investigated on larvae, pupae, adult males and egg-masses as well as on parasitism and defoliation in 1980 and partially in 1981. Treatment effects for diflubenzuron were not reported because of improper aerial application. Dipel and trichlorphon provided excellent foliage protection in 1980 and reduced populations of instars I to III by 87 and 38%, respectively. Enhancement of parasitism by *Apanteles melanoscelus* (Ratz.) was most apparent in blocks treated with *B. t.* subsp. *kurstaki*. Other positive and negative effects on parasitism were detected by both insecticides. The cost was less than that of standard application.

VANDENBERG J D; SHIMANUKI H

TWO COMMERCIAL PREPARATIONS OF THE BETA EXOTOXIN OF BACILLUS-THURINGIENSIS INFLUENCE THE MORTALITY OF CAGED ADULT HONEYBEES APIS-MELLIFERA HYMENOPTERA APIDAE

ENVIRON ENTOMOL 15 (1). 1986. 166-169.

Full Journal Title: Environmental Entomology

ABSTRACT

Two commercial preparations of thuringiensin, the beta. exotoxin produced by some strains of *Bacillus thuringiensis* Berliner, were tested for their effect on honey bees (*Apis mellifera* L.) ABG-6162 (ABG) and SAN410SC72 (SAN) were diluted in 50% sucrose. When bees were fed the toxin solutions throughout their life, only the most dilute preparation of ABG had no significant effect on LT50 of replicate cages of bees when compared with untreated controls. All other dilutions of ABG and SAN significantly reduced LT50. A single feeding per bee of a 5 times  $10^{-4}$  dilution resulted in no significant reduction in LT50 for ABG. Higher doses and all doses of SAN caused a significant reduction in LT50. When dilutions in sucrose solutions were sprinkled on bees in cages, only the highest dose of ABG significantly reduced LT50. Lower doses of ABG and all doses of SAN had no significant



impact on LT50. Based on low spray volumes and consequent high thuringiensin concentrations, it is possible but unlikely that foraging honey bees could be exposed to doses sufficient to reduce longevity. However, since sprays are water-based, it is unlikely that honey bees would be sufficiently attracted to it to consume a lethal dose. Furthermore, some spray volumes are large enough, and concentrations low enough, that no toxic effect is expected.

*VARLEZ S; JERVIS M A; KIDD N A C; CAMPOS M; MCEWEN P K*

EFFECTS OF BACILLUS THURINGIENSIS ON PARASITIDS OF THE OLIVE MOTH. PRAYS OLEAE BERN. (LEP., YPONOMEUTIDAE)

ZEITSCHRIFT FUER ANGEWANDTE ENTOMOLOGIE, 1993, 116 (3) 267-272

Language: English Summary Language: German

#### ABSTRACT

Field-collected larvae of the anthophagous generation of Prays oleae were sprayed with Foray 64B, a commercial formulation of Bacillus thuringiensis. The larvae were then reared in the laboratory, to determine whether the survival of larval parasitoids was adversely affected. The effects of Bt on adult parasitoids was also examined by exposing the insects to various diets including one containing the bacterium. Treatment of hosts with Bt was found to affect larval parasitoids adversely by increasing mortality of larval parasitoids within hosts surviving Bt treatment and by reducing the body size of adult parasitoids. The longevity of adult parasitoids was not adversely affected by Bt in the diet.

Keywords/ FORMULATION; SURVIVAL; MORTALITY; MICROBIOLOGICAL CONTROL, LONGEVITY; PARASITOID; NON TARGET EFFECT; OLEA EUROPAEA; PRAYS OLEAE; BACILLUS THURINGIENSIS VAR. KURSTAKI; SPAIN; CHELONUS ELAEAPHILUS

*\*\*WEBB, R.E.; SHAPIRO, M.; PODGWAITE, J.D.; REARDON, R.C.; TATMAN, K.M.; VENABLES, L.; KOLODNY-HIRSCH, D.M.*

EFFECT OF AERIAL SPRAYING WITH DIMILIN, DIPEL, OR GYPCHEK ON TWO NATURAL ENEMIES OF THE GYPSY MOTH (LEPIDOPTERA: LYMANTRIIDAE).

J-ECON-ENTOMOL. DEC 1989. V. 82 (6) 1695-1701.

Full Journal Title: Journal of Economic Entomology

LANGUAGE: English

#### ABSTRACT

The effects of three aerially applied insecticides on the incidence of two components of the natural enemy complex of the gypsy moth, *Lymantria dispar* (L.), were evaluated for the 1987 year of application. Application of Gypchek, a registered formulation of the gypsy moth nuclear polyhedrosis virus (NPV), initiated a large early-season (first-wave) epizootic of NPV; late-season NPV (second-wave) levels were higher in plots treated with Gypchek than in control plots, but not significantly so, whereas levels of the parasitoid *Cotesia melanoscela* (Ratzeburg) were significantly reduced in Gypchek-treated plots compared with control plots. Application of Dipel (*Bacillus thuringiensis* Berliner) resulted in a significant increase in numbers of *C. melanoscela*. Application of either Dipel or Dimilin (diflubenzuron) resulted in a significant decrease in incidence of NPV compared with control plots. Numbers of *C. melanoscela* in plots treated with Dimilin were not significantly different from those detected in control plots.

Keywords/ HARDWOODS-. LYMANTRIA-DISPAR. LARVAE-. MORTALITY-. AERIAL-SPRAYING. BACILLUS-THURINGIENSIS. DIFLUBENZURON-. INSECT-CONTROL. MARYLAND-.





## LEPIDOPTERA-BUTTERFLIES AND MOTHS

*BEIGER, M.*

THE EFFECT OF INSECTICIDES APPLIED AGAINST THE NUN MOTH ON THE OCCURRENCE AND ABUNDANCE OF LEAF-MINING INSECTS.

POLSKIE PISMO ENTOMOLOGICZNE 1987. 57 (2): 373-376 (3 REF.)

Language: Polish

Summary Language: English

Field trials in Poland in 1981-84 showed that Ripcord [cypermethrin], Decis [deltamethrin] and Bactospeine [*Bacillus thuringiensis* subsp. *thuringiensis*] applied against the forest pest *Lymantria monacha* significantly reduced the abundance of leaf-mining insects of the orders Lepidoptera, Diptera and Hymenoptera on forest trees and shrubs.

*JAMES,-R.R.; MILLER,-J.C.; LIGHTHART,-B.*

BACILLUS THURINGIENSIS VAR. KURSTAKI AFFECTS A BENEFICIAL INSECT, THE CINNABAR MOTH (LEPIDOPTERA: ARCTIIDAE).

J-ECON-ENTOMOL. APR 1993. V. 86 (2) 334-339.

Full Journal Title: Journal of Economic Entomology

Language: English

### ABSTRACT

The microbial insecticide *Bacillus thuringiensis* Berliner var. *kurstaki* is used to control forest pests in regions where tansy ragwort, *Senecio jacobaea* L., occurs. Biological control of this noxious weed may be compromised if the cinnabar moth, *Tyria jacobaeae* (L.), is susceptible to *B. thuringiensis*. In laboratory feeding tests, we found that foliage dipped in *B. thuringiensis* solutions had very little effect on survival of first, second, and third instars, but fourth and fifth instars were susceptible; LC50s were 0.31 and 0.22 mg formulation per ml (Dipel-hg; potency 4,320 IU/mg), respectively. Field tests were done to test the effect of *B. thuringiensis* on larval defoliation of potted tansy ragwort plants at five different application rates. The application rate significantly affected percentage of leaves defoliated and mean number of cinnabar moth-days per plant. In both control plants and those treated with *B. thuringiensis*, defoliation by cinnabar moth did not affect plant biomass within the 10-d course of the experiment. Results of the laboratory and field experiments suggest that the pesticide could interfere with the biological control of tansy ragwort if applied to areas where the weed occurs and when late-instar cinnabar moths are active. However, most applications for western spruce budworm, *Choristoneura occidentalis* Freeman, and gypsy moth, *Lymantria dispar* (L.), occur when only early instars of cinnabar moth are present.

Keywords/ BACILLUS-THURINGIENSIS. INSECTICIDAL-ACTION. TYRIA-JACOBAEAE. BENEFICIAL-INSECTS. BIOLOGICAL-CONTROL. SENECIO-JACOBAEA. WEED-CONTROL. OREGON-.

*JOHNSON, K. S.; SCRIBER, J. M.; NITAO, J.; SMITLEY, D.R.*

LONG-TERM PERSISTENCE OF BACILLUS THURINGIENSIS EFFECT ON NONTARGET LEPIDOPTERA IN FIELD STUDIES.

ENVIRON ENTOMOL (IN PRESS)

Full Journal Title: Environmental Entomology

Language: English

*LEONG,-K.L.H.; YOSHIMURA,-M.A.; KAYA,-H.K.*

LOW SUSCEPTIBILITY OF OVERWINTERING MONARCH BUTTERFLIES TO BACILLUS THURINGIENSIS BERLINER.

PAN-PAC-ENTOMOL. JAN 1992. V. 68 (1) P. 66-68.



Full Journal Title: Pacific Coast Entomological Society.  
Language: English

*MELIN, B.E.; COZZI, E.M.*

SAFETY TO NONTARGET INVERTEBRATES OF LEPIDOPTERAN STRAINS OF BACILLUS THURINGIENSIS AND THEIR BETA-EXOTOXINS

SAFETY OF MICROBIAL INSECTICIDES / EDITORS, MARSHALL LAIRD, LAWRENCE A. LACEY, ELIZABETH W. DAVIDSON. P. 149-167. BOCA RATON, FLA. : CRC PRESS, C1990.

Language: English

Literature review. Includes references.

*MILLER J C*

FIELD ASSESSMENT OF THE EFFECTS OF A MICROBIAL PEST CONTROL AGENT ON NONTARGET LEPIDOPTERA

AM ENTOMOL 36 (2). 1990. 135-139.

Full Journal Title: American Entomologist

ABSTRACT

Species in a guild of nontarget leaf-feeding Lepidoptera on Garry oak, *Quercus garryana* Dougl., were monitored in the field for a period of 3 yr (1986-1988) to assess the ecological effects of three applications of the microbial pest control agent, *Bacillus thuringiensis* Berliner var. *kurstaki* within a single-season application (spring 1986). The target species for the *B. thuringiensis kurstaki* application was the gypsy moth, *Lymantria dispar* (L.), in a large-scale eradication program in Lane County, Oregon, [USA]. Species richness in the guild of leaf-feeding Lepidoptera on Garry oak was significantly reduced in the treated plots during all 3 yr of the study. Also, the total number of individual nontarget Lepidoptera was significantly reduced in treated plots during the first 2 yr but not in the third. These data suggest that certain nontarget species of Lepidoptera may be ecologically "at risk" in large-scale pest control programs based on *B. thuringiensis kurstaki*. Variables such as phenology, voltinism, and plot size are discussed regarding the degree of risk and type of species that may be most affected by large-scale microbial pest control agent control and eradication programs.

Keywords/ BACILLUS-THURINGIENSIS-SUBSP.-KURSTAKI. INSECTICIDAL-ACTION. LEPIDOPTERA-. NONTARGET-EFFECTS. SPECIES-DIVERSITY. CEANOOTHUS-VELUTINUS. OREGON-.

*MILLER, J. C.*

EFFECTS OF A MICROBIAL INSECTICIDE, BACILLUS THURINGIENSIS KURSTAKI, ON NONTARGET LEPIDOPTERA IN A SPRUCE BUDWORM-INFESTED FOREST.

J RES LEPIDOPTERA VOL. 29. 1992 (4): P.267-276

Full Journal Title: Journal of Research on the Lepidoptera

ABSTRACT

Species in a guild of nontarget leaf-feeding Lepidoptera on *Ceanothus velutinus* were monitored in the field in Oregon to assess the effects of one application of *Bacillus thuringiensis* subsp. *kurstaki* against the tortricid *Choristoneura occidentalis*. The Lepidoptera were sampled to compare species richness, species evenness, species diversity, larval abundance and a dominance index between an untreated and a treated site over a period of 2 years. The guild of leaf-feeding Lepidoptera on *C. velutinus* consisted of 32 species, the most abundant being the geometrids *Eupithecia* sp. and *Drepanulatrix* sp., and the gelechiid *Chionodes* sp. No significant differences were observed in species evenness or diversity but the indices were lower in the untreated site in 3 of 4 post-treatment samples. A dominance index was consistently higher in the untreated site. The total number of larvae/100 s sample was significantly higher in the untreated site in early summer, 2 weeks after treatment. Also, larval abundance in the



early summer sample was significantly higher one year later. No differences were noted in larval abundance in the late summer sample in either year. 20 ref.

Keywords/ ORNAMENTAL WOODY PLANTS; INSECT PESTS; FOREST PESTS; BACTERIAL INSECTICIDES; PATHOGENS; NATURAL ENEMIES; CONTROL; BIOLOGICAL CONTROL; MICROBIAL PESTICIDES; EFFECTS; NONTARGET EFFECTS; ENTOMOPATHOGENIC BACTERIA; BROADLEAVES; INSECTICIDES; ECOLOGY; POLLUTION; CHEMICAL CONTROL; PEST CONTROL; AGRICULTURAL ENTOMOLOGY; BIOLOGICAL CONTROL AGENTS

*MUMMIGATTI, S. G.; RAGHUNATHAN, A. N.*

PRODUCTION OF *BACILLUS THURINGIENSIS* VAR. *KURSTAKI* BY THREE DIFFERENT METHODS AND ITS RELATIVE TOXICITY TO *BOMBYX MORI*.

J-INVERTEBR-PATHOL. MAR 1988. V. 51 (2) . 115-118.

Full Journal Title: Journal of Invertebrate Pathology

Keywords/ *BACILLUS THURINGIENSIS*. BACTERIAL-INSECTICIDES. CULTURE-METHODS. TOXICITY-. *BOMBYX MORI*.

*SAHA, B. N.; KHAN, A. R.; FARUKI, S. I.*

CHANGES IN LIPID AND WATER CONTENT OF *BOMBYX MORI* INGESTED WITH *BACILLUS THURINGIENSIS* VAR. *KURSTAKI*.

INDIAN JOURNAL OF SERICULTURE VOL. 33. 1994. (1): P.65-67

Language: English

ABSTRACT

The effect of Dipel (*Bacillus thuringiensis* subsp. *kurstaki*) applied to mulberry leaves on the lipid and water contents of 3 local races of *Bombyx mori* (BSRI-C, MBW-062(D) and URBASHI) was determined in the laboratory. Treatment with Dipel reduced the lipid content and increased the water content significantly in each strain. Possible reasons for this effect are discussed. 10 ref.

Keywords/ SILKWORMS; BENEFICIAL INSECTS; INSECTICIDES; PESTICIDES, MICROBIAL PESTICIDES; BACTERIAL INSECTICIDES; NONTARGET EFFECTS; MULBERRIES: EFFECTS; ENTOMOPATHOGENIC BACTERIA; AGRICULTURAL ENTOMOLOGY

*WAGNER, D. L.; PEACOCK, J. W.; TALLEY, S. E.*

A FIELD ASSESSMENT OF THE EFFECTS OF *BACILLUS THURINGIENSIS* VAR. *KURSTAKI* ON NON-TARGET LEPIDOPTERA

J ECON ENTOMOL (IN PRESS)

Full Journal Title: Journal of Economic Entomology



## NEMATODES

MEADOWS J; GILL S S; BONE L W

FACTORS INFLUENCING LETHALITY OF BACILLUS-THURINGIENSIS-KURSTAKI TOXIN FOR EGGS AND LARVAE OF TRICHOSTRONGYLUS-COLUBRIFORMIS NEMATODA

J PARASITOL 75 (2). 1989. 191-194.

Full Journal Title: Journal of Parasitology

### ABSTRACT

A toxin from *Bacillus thuringiensis kurstaki* was lethal to eggs and first- and second-stage larvae of the ruminant nematode *Trichostrongylus colubriformis*. Sheathed and exsheathed third-stage larvae were also killed by the toxin. However, susceptibility of the ova to the toxin decreased after several hours of development. Heating at 65 C for 1 hr or freezing at 0 C for 3 mo did not affect stability of the toxin. Ovicidal activity of the toxin was not altered by treatment with 13 microbial or mammalian enzymes, but toxicity was reduced by the antibiotics streptomycin or penicillin G and the enzyme inhibitor L-1-tosylamide 2-phenylethylchloromethyl ketone. Cuprous, ferrous, and zinc chlorides also inhibited the ovicidal activity of the toxin. Increased osmolarity of the assay media or solubilization of the toxin from pH 3 to 11 had no effect on toxicity for eggs. The membrane agents sodium vanadate and 4,4'-diisothiocyano-2,2'-disulfonic acid stilbene increased (9-fold) and decreased (333-fold) toxicity, respectively. N-acetylneuraminic acid was the only tested sugar that reduced the toxicity of *B. t. kurstaki*.





## NEUROPTERA-LACEWINGS

*HAVERTY, M. I.*

SENSITIVITY OF SELECTED NONTARGET INSECTS TO THE CARRIER OF DIPEL 4L IN THE LABORATORY.

ENVIRONMENTAL ENTOMOLOGY 1982. 11 (2): 337-338 (2 REF.)

### ABSTRACT

A 3:1 mixture of water and the carrier of Dipel 4L (a non-aqueous, emulsifiable suspension of *Bacillus thuringiensis* subsp. *kurstaki*) was applied to selected insect predators and a parasite in a controlled laboratory environment. Corrected mortality from the 9.4-litre/ha application never exceeded 2.1% for any species. The 18.7-litre/ha rate resulted in a statistically significant increase in mortality for adults of the chrysopid *Chrysoperla carnea* (Steph.) (*Chrysopa carnea*) and the coccinellid *Hippodamia convergens* (Guer.) 3 and 7 days after treatment, but not for larvae of *C. carnea* or adults of the aphelinid *Aphytis melinus* DeBach. Corrected mortality for the higher application rate never exceeded 13.4% for any species.



## VERTEBRATES



## BIRDS

**\*\*BUCKNER, C. H.; MCLEOD, B. B.**

IMPACT OF EXPERIMENTAL SPRUCE BUDWORM (CHORISTONEURA FUMIFERANA CLEMENS) SUPPRESSION TRIALS UPON FOREST DWELLING BIRDS IN NEWFOUNDLAND IN 1977.

REPORT, FOREST PEST MANAGEMENT INSTITUTE, CANADA 1977. (NO. FPM-X-9): 80 PP. (2 REF.)

### ABSTRACT

Aminocarb at 0.07 and 0.087 kg/ha a.i. did not damage bird populations or interrupt breeding. Trials involving two applications of fenitrothion (0.21 kg/ha a.i.) followed by aminocarb (0.07 kg/ha a.i.) caused a short-term decline in the activity of warblers (Parulidae). Acephate (0.056 kg/ha a.i.) combined with *Bacillus thuringiensis* (19.8 BIU/ha) and applied twice reduced warbler activity. From authors' summary.

**NEDKOVA, L.; GABRASHANSKI, P.; DEYANOV, T.; KOICHEV, K.; KOCHEV, P.**

DIPEL - A HIGHLY EFFECTIVE BIOPREPARATION. EFFECT ON THE HEALTH OF WILD ANIMALS IN OUR COUNTRY.

RASTITELNA ZASHCHITA 1980. 28 (2): 7-10

Language: Bulgarian

### ABSTRACT

Tests in Bulgaria have shown that the preparation of *Bacillus thuringiensis* named Dipel [see preceding abstract] is harmless to man, animals and useful insects. In the work described, it was confirmed that it is harmless to birds, and in particular to those that prey on lepidopterous pests of apple and walnut. Sprays were applied from the air over orchards in which caged birds were exposed to normal doses of the material, and observations were made after 7 days. There were no harmful effects.

**RODENHOUSE, N; HOLMES, R.**

RESULTS OF EXPERIMENTAL AND NATURAL FOOD REDUCTIONS FOR BREEDING BLACK-THROATED BLUE WARBLERS

ECOLOGY 73. 1992. 357-373

Full Journal Title: Ecology

Language: English

Keywords/ ABIES-RELIGIOSA. DANAUS-PLEXIPPUS. FOREST-PESTS. GEOMETRIDAE-. BIOLOGICAL-CONTROL. BACILLUS-THURINGIENSIS. PSEUDOMONAS-FLUORESCENS. CALIFORNIA-. MEXICO-.



## MAMMALS

**\*\*BELLOCQ, M. I.; BENDELL, J. F.; CADOGAN, B. L.**

EFFECTS OF THE INSECTICIDE BACILLUS THURINGIENSIS ON SOREX CINEREUS (MASKED SHREW) POPULATIONS, DIET AND PREY SELECTION IN A JACK PINE PLANTATION IN NORTHERN ONTARIO.

CANADIAN JOURNAL OF ZOOLOGY VOL. 70. 1992. (3): P.505-510

### ABSTRACT

The effects of a simulated operational spray with *Bacillus thuringiensis* subsp. *kurstaki* (Dipel 8L at 30 billion international units and 1.8 litres/ha) on masked shrew (*Sorex cinereus*) in a jack pine (*Pinus banksiana*) plantation in Ontario were studied during May-July 1989. During the pretreatment period, the abundance and population structure of *S. cinereus* were similar in the control and experimental areas. Although the total abundance of shrews was also similar after spraying, there were fewer adult males and more juveniles in the treated than the untreated area. The emigration of adult males was apparently increased after spraying. Larvae of Lepidoptera and Araneae were the most abundant diet items. After spraying, more lepidopteran larvae were eaten in untreated than treated areas. Juveniles and adult females but not adult male shrews shifted from lepidopteran larvae to alternative prey in the treated area. Generalist insectivores such as *S. cinereus* are more likely to control the abundance of arthropods and less likely to be negatively affected by selective insecticides such as *B. thuringiensis*. 23 ref.

Keywords/ BACTERIAL INSECTICIDES; PATHOGENS; NONTARGET EFFECTS; INSECTICIDES; MICROBIAL PESTICIDES; EFFECTS; ENTOMOPATHOGENIC BACTERIA; FORESTS; PREDATORS; PREY; FOREST PESTS; PESTICIDES; AGRICULTURAL ENTOMOLOGY; BIOLOGICAL CONTROL AGENTS

**\*\*INNES D G L; BENDELL J F**

THE EFFECTS ON SMALL-MAMMAL POPULATIONS OF AERIAL APPLICATIONS OF BACILLUS-THURINGIENSIS FENITROTHION AND MATACIL USED AGAINST JACK PINE BUDWORM IN ONTARIO CANADA

CAN J ZOOL 67 (5). 1989. 1318-1323. CODEN: CJZOA

Full Journal Title: Canadian Journal of Zoology

### ABSTRACT

In late June 1985, both operational and experimental aerial spraying was conducted against an outbreak of jack pine budworm (*Choristoneura pinus*) in northern Ontario. We report the effects of the insecticides *Bacillus thuringiensis*, fenitrothion, and Matacil on populations of rodents and shrews in young (20 years) and medium-aged (40 years) jack pine (*Pinus banksiana*) plantations. Live, snap, and pitfall traps were used to monitor small-mammal populations from early June to late August on four sprayed plots and two control plots. We found no statistically significant differences in abundances that could be attributed to an insecticide. However, pitfall trapping suggested that the abundance of shrews was altered by the fenitrothion spray. Both the pattern and magnitude of shrew captures were different relative to a control and two other treatment plots. This difference may have resulted from the lack of available prey (arthropods) on the fenitrothion plot. With the exception of fenitrothion, our results agree with other studies which suggest that standard applications of insecticides to control forest insects have no detectable or only limited impact on small mammals.

MAMMALIAN SAFETY OF MICROBIAL AGENTS FOR VECTOR CONTROL: A WHO MEMORANDUM

WORLD HEALTH ORGANIZATION/GENEVA 1211, SWITZERLAND

Journal: BULL. W.H.O., 1981, 59 (6) 857-863

Language: ENGLISH





## PLANTS



*GOLDBURG,-R.J.; NY,-NY; TJADEN,-G.*  
ARE B.T.K. PLANTS REALLY SAFE TO EAT  
BIO/TECHNOL. NOV 1990. V. 8 (11) 1011-1015.

Keywords/ LYCOPERSICON-ESCULENTUM. INSECT-PESTS. LEPIDOPTERA-. BACILLUS-  
THURINGIENSIS-SUBSP.-KURSTAKI. FOOD-SAFETY. TOMATOES-. ENDOTOXINS-.  
TRANSGENICS-.



SOIL



VISSER, S.; ADDISON, J. A.; HOLMES, S. B.

EFFECTS OF DIPEL(R) 176, A BACILLUS THURINGIENSIS SUBSP. KURSTAKI (B.T.K.) FORMULATION, ON THE SOIL MICROFLORA AND THE FATE OF B.T.K. IN AN ACID FOREST SOIL: A LABORATORY STUDY.

CANADIAN JOURNAL OF FOREST RESEARCH VOL. 24 1994. (3): P.462-471

#### ABSTRACT

The effects of DiPel(R) 176, a commercially available *Bacillus thuringiensis* subsp. *kurstaki* (B.t.k.) formulation, on microbially mediated carbon and nitrogen mineralization processes, and the persistence of B.t.k. after application to an acidic coniferous soil were evaluated in the laboratory. Litter (L) and fermentation-humus (FH) material from an acidic coniferous forest in Ontario (dominated by *Picea glauca* and *Abies balsamea*) soil were exposed to DiPel(R) at the recommended field application rate (FA), DiPel(R) at 1000x the field application rate (1000x FA), or left untreated. Respiration, substrate induced respiration (SIR), microbial biomass C, metabolic quotients (qCO<sub>2</sub>), NH<sub>4</sub>-N, NO<sub>3</sub>-N, cellulose decay, and B.t.k. viability were monitored regularly over 8 weeks. The FA treatment had no significant effect on soil processes in either L or FH. The 1000x FA treatment increased SIR and biomass C and decreased qCO<sub>2</sub> consistently in both L and FH. No other effects of the 1000x FA treatment were evident in L, while in FH this treatment stimulated respiration initially, then reduced it below control levels; it also enhanced cellulose decay and inhibited ammonification and nitrification after 8 weeks incubation. In both L and FH there was no significant loss in viability of B.t.k. in either of the DiPel(R) treatments over 8 weeks. The microcosms used in this study were simple, inexpensive, and effective, with respiration, SIR, biomass C, and qCO<sub>2</sub> being the least variable measurements and the most sensitive to perturbation. This approach is recommended for ecotoxicological and fate testing as outlined in the Guidelines for Registration of Naturally Occurring Microbial Pest Control Agents (Agriculture Canada 1990). 41 ref

Keywords/ FOREST TREES; SOIL BIOLOGY; PERSISTENCE; MICROBIAL PESTICIDES. MICROORGANISMS; NONTARGET ORGANISMS; MINERALIZATION. RESPIRATION; CARBON CYCLE; NITROGEN CYCLE; FOREST LITTER; HUMUS; DECOMPOSITION; BIOLOGICAL CONTROL AGENTS; FOREST SOILS; INSECTICIDES; BACTERIAL INSECTICIDES. NONTARGET EFFECTS; SOIL FLORA; SOIL CHEMISTRY; LABORATORY TESTS; EFFECTS. SOIL; BIOLOGICAL ACTIVITY IN SOIL; SOIL TYPES (ECOLOGICAL); ENVIRONMENT; PESTICIDES; AGRICULTURAL ENTOMOLOGY





## MISCELLANEOUS



HASSAN, S. A.

SIDE-EFFECTS OF PLANT PROTECTION COMPOUNDS ON BENEFICIAL ARTHROPODS.  
NACHRICHTENBLATT DES DEUTSCHEN PFLANZENSCHUTZDIENSTES 1984. 36 (1): 6-8 (13  
REF.)

ABSTRACT

The side-effects of 20 insecticides, 12 fungicides and 8 herbicides on 13 species of beneficial arthropods are indicated according to their degree of harmfulness (harmless, or slightly, moderately or very harmful). The least harmful of the test substances to most of the arthropods included the insecticides fenbutatin oxide (Torque), benzoximate (Aazomate), Dipel [*Bacillus thuringiensis* var. *kurstaki*] and diflubenzuron (Dimilin) as well as 8 of the fungicides and 4 of the herbicides.

\*\*WOODS SA; ELKINTON JS; SHAPIRO M

EFFECTS OF *BACILLUS-THURINGIENSIS* TREATMENTS ON THE OCCURRENCE OF  
NUCLEAR POLYHEDROSIS-VIRUS IN GYPSY-MOTH (LEPIDOPTERA, LYMANTRIIDAE)  
POPULATIONS

JOURNAL OF ECONOMIC ENTOMOLOGY, 1988, V81, N6, P1706-1714

OPERATIONAL FIELD TRIALS AGAINST THE DOUGLAS-FIR TUSsock MOTH WITH  
CHEMICAL AND BIOLOGICAL INSECTICIDES. AN INTERNATIONAL RESEARCH AND  
CONTROL PROGRAM CONDUCTED IN BRITISH COLUMBIA, 1975-1976.  
PACIFIC FOREST RESEARCH CENTRE, VICTORIA, BRITISH COLUMBIA, V8Z 1M5, CANADA.  
INFORMATION REPORT, CANADIAN FORESTRY SERVICE 1980. (NO. BC-X-201): 19 PP. (29  
FIG. (MANY COL.))

ABSTRACT

An aerial spray programme with *Bacillus thuringiensis* against *Orgyia pseudotsugata* (McDunn.) on Douglas fir (*Pseudotsuga menziesii*) in British Columbia in 1975 was only partially effective in controlling an outbreak. Experimental trials with different formulations, volumes and concentrations showed that mixtures of Thuricide with molasses were the most effective if applied at 9.5 litres/ha. Lower volumes or mixtures with sorbitol decreased the effectiveness, and higher concentrations of the pathogen did not improve it. The bark-beetle *Dendroctonus pseudotsugae* Hopk. increased rapidly in 1975 and 1976, especially in Douglas firs that had been weakened by defoliation, leading to a large trap-log programme to control this insect. The induction of a nuclear polyhedrosis virus disease through aerial application controlled populations of *O. pseudotsugata*; defoliation in the year of application was moderate, but no trees died and no larvae could be found in the following year. Acephate and diflubenzuron (Dimilin) were tested experimentally in 1975, and acephate was used operationally in 1976. Both materials were effective in reducing populations and preventing defoliation. Acephate was fast-acting with a short residual effect, while diflubenzuron acted slower but persisted longer. Effects on non-target organisms were minimal.



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